

CLAIMS:

1. An image processing apparatus comprising image data storing means for storing digital image data obtained by photoelectrically detecting light with a CCD to produce analog image data and digitizing
5 the analog pixel data, memory means for two-dimensionally mapping and storing the digital image data stored in the image data storing means, and abnormal pixel determining means for specifying each pixel in the digital image data stored in the memory means as a subject pixel, reading
10 density signal level of the subject pixel together with density signal levels of pixels adjacent to the subject pixel, comparing the density signal level of the subject pixel with the density signal levels of pixels adjacent to the subject pixel and defining the subject pixel as an abnormal pixel when
15 difference between the density signal level of the subject pixel and the density signal levels of pixels adjacent to the subject pixel is greater than a predetermined level.

2. An image processing apparatus in accordance with Claim 1 which further comprising abnormal pixel correcting means for correcting the density signal level of each subject pixel in accordance with the density
20 signal levels of the pixels adjacent to the subject pixel when the subject pixel is defined as an abnormal pixel by the abnormal pixel determining means.

3. An image processing apparatus in accordance with Claim 1 wherein the abnormal pixel determining means is constituted so as to determine whether the density signal level of each subject pixel is higher
25 than a maximum value of the density signal levels of the pixels adjacent to the subject pixel and whether or not the density signal level of the subject pixel is lower than a minimum value of the density signal levels of the pixels adjacent to the subject pixel, and judge whether or not the

difference between the density signal level of the subject pixel and the density signal levels of pixels adjacent to the subject pixel is greater than the predetermined level when the density signal level of the subject pixel is higher than the maximum value of the density signal levels of the pixels adjacent to the subject pixel or when the density signal level of the subject pixel is lower than the minimum value of the density signal levels of the pixels adjacent to the subject pixel.

4. An image processing apparatus in accordance with Claim 2 wherein the abnormal pixel determining means is constituted so as to determine whether the density signal level of each subject pixel is higher than a maximum value of the density signal levels of the pixels adjacent to the subject pixel and whether or not the density signal level of the subject pixel is lower than a minimum value of the density signal levels of the pixels adjacent to the subject pixel, and judge whether or not the difference between the density signal level of the subject pixel and the density signal levels of pixels adjacent to the subject pixel is greater than the predetermined level when the density signal level of the subject pixel is higher than the maximum value of the density signal levels of the pixels adjacent to the subject pixel or when the density signal level of the subject pixel is lower than the minimum value of the density signal levels of the pixels adjacent to the subject pixel.

5. An image processing apparatus in accordance with Claim 1 wherein the abnormal pixel determining means is constituted so as to calculate an average value A, the maximum value MAX and the minimum value MIN of the density signal levels of pixels adjacent to each subject pixel and judge that the difference between the density signal level of the subject pixel and the density signal levels of the pixels adjacent to the subject pixel is greater than the predetermined level when the density

signal level x of the subject pixel satisfies:

$$x > A + (\text{MAX-MIN}) * n, \text{ or}$$

$$x < A + (\text{MAX-MIN}) * n$$

wherein n is a positive constant.

- 5 6. An image processing apparatus in accordance with Claim 2 wherein the abnormal pixel determining means is constituted so as to calculate an average value A, the maximum value MAX and the minimum value MIN of the density signal levels of pixels adjacent to each subject pixel and judge that the difference between the density signal level of the
- 10 subject pixel and the density signal levels of the pixels adjacent to the subject pixel is greater than the predetermined level when the density signal level x of the subject pixel satisfies:

$$x > A + (\text{MAX-MIN}) * n, \text{ or}$$

$$x < A + (\text{MAX-MIN}) * n$$

- 15 wherein n is a positive constant.

7. An image processing apparatus in accordance with Claim 3 wherein the abnormal pixel determining means is constituted so as to calculate an average value A, the maximum value MAX and the minimum value MIN of the density signal levels of pixels adjacent to each subject
- 20 pixel and judge that the difference between the density signal level of the subject pixel and the density signal levels of the pixels adjacent to the subject pixel is greater than the predetermined level when the density signal level x of the subject pixel satisfies:

$$x > A + (\text{MAX-MIN}) * n, \text{ or}$$

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$$x < A + (\text{MAX-MIN}) * n$$

wherein n is a positive constant.

8. An image processing apparatus in accordance with Claim 4 wherein the abnormal pixel determining means is constituted so as to

calculate an average value A, the maximum value MAX and the minimum value MIN of the density signal levels of pixels adjacent to each subject pixel and judge that the difference between the density signal level of the subject pixel and the density signal levels of the pixels adjacent to the subject pixel is greater than the predetermined level when the density signal level x of the subject pixel satisfies:

$$x > A + (MAX - MIN) * n, \text{ or}$$

$$x < A + (MAX - MIN) * n$$

wherein n is a positive constant.

9. An image processing apparatus in accordance with Claim 5 wherein the positive constant n is set between 1 and 2.

10. An image processing apparatus in accordance with Claim 6 wherein the positive constant n is set between 1 and 2.

11. An image processing apparatus in accordance with Claim 7 wherein the positive constant n is set between 1 and 2.

12. An image processing apparatus in accordance with Claim 8 wherein the positive constant n is set between 1 and 2.

13. An image processing apparatus in accordance with Claim 2 wherein the abnormal pixel correcting means is constituted so as to correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the minimum value.

14. An image processing apparatus in accordance with Claim 3 wherein the abnormal pixel correcting means is constituted so as to correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the

density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the minimum value.

15. An image processing apparatus in accordance with Claim 4
5 wherein the abnormal pixel correcting means is constituted so as to correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the
10 minimum value.

16. An image processing apparatus in accordance with Claim 5
wherein the abnormal pixel correcting means is constituted so as to correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the
15 density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the minimum value.

17. An image processing apparatus in accordance with Claim 6
wherein the abnormal pixel correcting means is constituted so as to
20 correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the minimum value.

25 18. An image processing apparatus in accordance with Claim 7 wherein the abnormal pixel correcting means is constituted so as to correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the

density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the minimum value.

19. An image processing apparatus in accordance with Claim 8
5 wherein the abnormal pixel correcting means is constituted so as to correct the density signal level of each subject pixel in such a manner that the corrected density signal level is equal to an average value of the density signal levels of the pixels adjacent to the subject pixel excluding the pixels whose density signal levels have the maximum value and the
10 minimum value.

20. An image processing apparatus in accordance with Claim 1 wherein the pixels adjacent to the subject pixel are the group of pixels obtained by excluding the subject pixel from $3 * 3$ pixels including the subject pixel as a center pixel.

21. An image processing apparatus in accordance with Claim 2
15 wherein the pixels adjacent to the subject pixel are the group of pixels obtained by excluding the subject pixel from $3 * 3$ pixels including the subject pixel as a center pixel.

22. An image processing apparatus in accordance with Claim 3
20 wherein the pixels adjacent to the subject pixel are the group of pixels obtained by excluding the subject pixel from $3 * 3$ pixels including the subject pixel as a center pixel.

23. An image processing apparatus in accordance with Claim 4
25 wherein the pixels adjacent to the subject pixel are the group of pixels obtained by excluding the subject pixel from $3 * 3$ pixels including the subject pixel as a center pixel.

24. An image processing apparatus in accordance with Claim 5 wherein the pixels adjacent to the subject pixel are the group of pixels

obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

25. An image processing apparatus in accordance with Claim 6 wherein the pixels adjacent to the subject pixel are the group of pixels
5 obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

26. An image processing apparatus in accordance with Claim 7 wherein the pixels adjacent to the subject pixel are the group of pixels
10 obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

27. An image processing apparatus in accordance with Claim 8 wherein the pixels adjacent to the subject pixel are the group of pixels
obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

15 28. An image processing apparatus in accordance with Claim 13 wherein the pixels adjacent to the subject pixel are the group of pixels obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

29. An image processing apparatus in accordance with Claim 14
20 wherein the pixels adjacent to the subject pixel are the group of pixels obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

30. An image processing apparatus in accordance with Claim 15 wherein the pixels adjacent to the subject pixel are the group of pixels
25 obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

31. An image processing apparatus in accordance with Claim 16 wherein the pixels adjacent to the subject pixel are the group of pixels

obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

32. An image processing apparatus in accordance with Claim 17 wherein the pixels adjacent to the subject pixel are the group of pixels
5 obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

33. An image processing apparatus in accordance with Claim 18 wherein the pixels adjacent to the subject pixel are the group of pixels
10 obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

34. An image processing apparatus in accordance with Claim 19 wherein the pixels adjacent to the subject pixel are the group of pixels
obtained by excluding the subject pixel from 3 * 3 pixels including the subject pixel as a center pixel.

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